Chapter 6
PROPOSED MINIMUM FLOW CRITERIA, MONITORING, PREVENTION, RESEARCH, AND ADAPTIVE MANAGEMENT STRATEGIES

PROPOSED CRITERIA

As a result of the MFL criteria development process described in **Chapter 4** and **Chapter 5** of this document, District staff recommend a minimum mean monthly flow of more than 28 cfs from the North and South Forks of the St. Lucie River combined to maintain sufficient salinities in the St. Lucie Estuary. The ***harm*** criteria is exceeded when flows fall below the 28-cfs minimum for two consecutive months during the dry season (November through April). ***Significant harm*** occurs if the harm criteria are exceeded for two consecutive years. To protect low salinity areas in the upper reaches of the North and South Forks, these flows should be distributed to provide 21 cfs from the North Fork River and 7 cfs from the South Fork. A summary of flow salinity relationships that were used to determine these criteria is provided below.

St. Lucie Estuary

Net freshwater flows are the sum of surface and ground water inflows minus evaporation. Net freshwater flows to the estuary were at or below zero during 14 months of the 31-year NSM simulation period. During such events, which may persist for 1 to 3 months, it can be expected that the oligohaline habitat will no longer be present in the estuary.

Harm *is defined to occur when net freshwater flows to the estuary system are less than the rate of evaporation for a period of two consecutive months.*

Such conditions occurred 5 times during the period of simulation, representing a return frequency of about 6 years under natural system conditions. Because such low flow and no flow events occurred under natural conditions, as well as under present conditions, the extent to which such occurrences constitute “significant harm” to the ecosystem is based on the definition that has been formally adopted by the SFWMD:

Significant harm occurs when freshwater flows to the estuary are less than the rate of evaporation for a period of two consecutive months for two or more years in succession.

Such an event did not occur during the 31-year period for the St. Lucie Estuary under either current (1995 Base Case) or historic (NSM) simulations.

District staff recognize that these definitions are not exact. The concept is based on the presumption that any loss of oligohaline zone habitat beyond what occurred under natural conditions (as simulated by the NSM) represents some degree of ***harm*** to the system. The exact point at which this loss becomes ***significant harm*** cannot be determined without additional study of the hydrology of the system and the resources at risk. Lacking this precise knowledge, the selected approach represents a conservative standard.

North Fork

Results of modeling studies indicate that flows at or below 21 cfs occur in the North Fork during periods when significant harm is occurring in the St. Lucie Estuary. No evidence has been found to indicate that, under current operations, oligohaline habitat is being lost beyond the extent of the zone that occurred historically.

South Fork

Preliminary analyses of the limited amount of available information indicate that a flows at or below 7 cfs occur from the South Fork during periods when significant harm is occurring in the St. Lucie Estuary. Although these preliminary results indicate that no impacts are likely to occur in the South Fork as a result of current and proposed management actions, further analyses of this system are warranted to refine management targets for inclusion in future updates to the MFL criteria. These refinements should include more detailed analyses of basin topography and hydrography; assessment of biological communities in the river that need to be protected; improved modeling of flow from the watershed to the South Fork; and development of a model or mathematical relationship to determine salinity conditions in the South Fork as a function of flow.

ABILITY TO MEET THE PROPOSED CRITERIA

Data and modeling studies indicate that under current (1995 Base Case) conditions, more fresh water is being discharged into the North Fork during dry periods than was discharged historically. This increased flow during low flow periods has resulted in a decreased probability that net inflows of fresh water will equal zero cfs or less throughout the estuary. There is no evidence that the proposed significant harm criteria will be exceeded in this system under present conditions.

Examination of the North and South Forks indicates that both of these systems support viable oligohaline habitats. The exact extent and duration of the oligohaline zones in these systems is uncertain. Flows of less than 21 cfs from the North Fork occur during periods when net flow of fresh water to the estuary is zero or less. Flows from the North Fork should be maintained above this level during periods when other sources of freshwater input to the estuary are restricted.

Flows of less than 7 cfs from the South Fork occur during periods when net flow of fresh water to the estuary is zero or less. Flows from the South Fork should be maintained above this level during periods when other sources of freshwater input to the estuary are restricted. Currently, we are limited in the ability to both monitor South Fork flows and provide conveyance options to supplement flows.

MONITORING STRATEGY

During the peer review, the panel suggested that the ability to achieve the proposed MFL should be monitored. This monitoring should be based on a number of different approaches, each of which has certain advantages and disadvantages.

First, efforts should be made to improve monitoring of freshwater inflows from major streams and tributaries. In addition, the District should attempt to obtain better information on the amount of fresh water that enters the system through ground water. Such improved quantification of freshwater inflows will provide a better, although indirect, indication that oligohaline resources are being protected.

To provide further confirmation, salinity should be monitored at selected points within the rivers and estuary. Salinity measurements at selected points will not likely measure the exact location of the oligohaline zone and, therefore, must be used in conjunction with other information.

The hydrodynamic model should be run periodically, using current hydrologic and salinity data, to estimate the extent and relative stability of the oligohaline zone. The watershed models should also be run, using the improved surface and ground water flow data to develop periodic water budget analyses to determine the net inflow of fresh water to the system.

Finally, the ability to successfully prevent significant harm from occurring to oligohaline habitats within the system requires documenting species composition, locations of communities, and the relative abundance within the system of those species that utilize and/or depend on low salinity conditions for growth and reproduction.

Data Collection and Monitoring

The Gordy Road Structure within the North Fork of the St. Lucie River basin is currently monitored in conjunction with the Upper East Coast Water Quality Sampling Network. Continued data collection at this site is recommended to monitor North Fork flows. No structure currently exists to monitor flows on the South Fork of the St. Lucie River. Staff is proposing the addition of a flow station, at a suitable site that is still to be determined, located upstream of saltwater influence on the South Fork.

The District and other agencies also collect flow data from other tributaries and canals, and rainfall data in the watershed. These monitoring efforts need to be continued to

provide additional hydrologic data that can be used to refine the existing and future models.

Other District programs are underway to collect ground water and water quality data in the St. Lucie Estuary and other areas. Such information can be used to provide better estimates of total freshwater input to the estuary and the effects of freshwater flow on water quality. Data from these programs needs to be further evaluated to determine whether they can be effectively used to monitor exceedances or refine MFL criteria.

Additional monitoring of biological communities is also needed within the estuary. Benthic communities are an important component of the system. Historically, these communities have been impacted by the influx of large amounts of sediments and suspended solids from canal and tributary inflows. Studies of the distribution and composition of benthic communities and effects of sedimentation provide a means to assess the extent and health of the oligohaline zone. Pelagic and planktonic communities also need to be monitored to document the spatial and temporal distribution and biomass of phytoplankton, zooplankton, and fishes within the system.

Determination of Compliance with Criteria

MFL Criteria will be met if the following is fulfilled:

- Inflow measurements from the North Fork of the St. Lucie River remain above the levels needed to prevent significant harm from occurring in the oligohaline zone
- Results of analyses using the watershed models indicate that adequate inflow of fresh water is occurring throughout the system to prevent significant harm from occurring to oligohaline habitat
- Monitoring indicates that biological communities in the river and estuary are not being adversely impacted by high salinity conditions

Failure to meet one or more of these conditions, to the extent that loss of oligohaline habitat occurs in the estuary for two successive months during the dry season, constitutes harm to the system. If system monitoring data indicates that such harm conditions exist during two years in a row, significant harm occurs.

PREVENTION STRATEGY

Since the proposed significant harm criteria are not presently being exceeded, a recovery strategy does not need to be developed for this system. Furthermore, changes that are proposed for the watershed as part of the Indian River Lagoon Feasibility Study (USACE and SFWMD, 2001) are designed to provide additional retention basins along the river. These retention basins will reduce the amount and frequency of high volume discharges and can potentially provide additional water for discharge to the river during

dry periods. With these features in place, the probability of exceeding the proposed MFL in the future criteria may be further reduced.

However, the ability to better manage water in the watershed may also make it possible to capture and retain water from the watershed for allocation to other (e.g., urban and agricultural water supply) purposes. Under such conditions, future dry season flows to the estuaries could be reduced rather than increased. For this reason, the following management approach is proposed that is intended to ensure protection of the oligohaline zone in the North and South Forks:

- Discharges from the North Fork of the St. Lucie River should be maintained above 21 cfs to prevent significant harm from occurring in the St. Lucie Estuary. Discharges will be managed within the operational protocols of the Ten Mile Creek Project, scheduled to be completed by 2004 (Appendix K). Flow targets will be consistent with CERP performance requirements for Indian River Lagoon restoration.
- Discharges from the South Fork should be maintained above 7 cfs to prevent significant harm from occurring.
- Due to water quality and discharge location concerns, releases of water through the C-23, C-24, and C-44 Canals are not considered effective means of providing flows to prevent significant harm from occurring to the St. Lucie River and Estuary.
- Studies are under way to collect additional topographic and hydrologic data needed to improve the models that are used in the South Fork basin. Additional biological and water quality studies are also needed to determine the salinity conditions and the quality and extent of oligohaline habitat that are produced by various flow regimes. Assessments are also needed to identify particular resources in this river that need to be protected.
- Similarly, additional research and monitoring are needed to refine existing data and models, improve the flow estimates, and characterize biological resources within the North Fork. Research priorities are itemized in the next section.

RESEARCH STRATEGY

As previously stated in **Chapter 4**, the District supports the application of the valued ecosystem component (VEC), a resource-based management strategy approach. The VEC approach is based on the concept that management goals for the St. Lucie River and Estuary can best be achieved by providing suitable environmental conditions that will support certain key species, or key groups of species, that inhabit this system. Detailed below are relevant ongoing and anticipated research efforts in support of St. Lucie River and Estuary MFL development (Doering, 2001)

Watershed Modeling

The need for improved watershed modeling is driving a number of research efforts. Better models are being developed, including three-dimensional models, and additional hydrologic and topographic data are being collected to support these models. A water quality model of the estuary is also being developed, primarily to support the SWIM programs for the Indian River Lagoon and the St. Lucie Estuary. This model will also be used to help determine Pollutant Load Reduction Goals (PLRGs) and TMDLs for the St. Lucie Estuary and to assess the effects of the proposed MFL criteria on estuarine water quality.

Salinity Research

During Fiscal Year 2002, the District will initiate an investigation of the North Fork of the St. Lucie River and Estuary. The purpose of the study is to characterize 1) the extent of the oligohaline zone as a function of freshwater inflow, and 2) the spatial and temporal distribution of chlorophyll *a* (phytoplankton) biomass, zooplankton biomass, and larval and juvenile fish. The results will address the use of the North Fork as a nursery area. Also, during Fiscal Year 2003, investigations need to be undertaken in the South Fork to determine if similar conditions and resources exist in that portion of the system.

The responses of benthic plants and oysters to rapid changes in salinity will be examined in a series of controlled experiments. These experiments will be conducted at the Gumbo Limbo Mesocosm Facility.

Water Quality

The District has a water quality modeling program for the St. Lucie River and Estuary in place. Studies of phytoplankton productivity and respiration and the benthic input of nutrients have been completed as part of this program. Studies to quantify nutrient loads are still under way.

Sediments

The accumulation of fine grained muck sediments in the St. Lucie River and Estuary has been examined in the past. It is presently being revisited in anticipation of large-scale dredging by the United States Army Corps of Engineers.

Adaptive Management

Based on best available information, a minimum flow has been proposed for the St. Lucie River and Estuary with the understanding that more information is needed to refine assumptions used in criteria development. Ongoing and proposed research and monitoring in the St. Lucie River and Estuary watershed are designed to provide data to fill gaps in our understanding of the ecosystem, specifically targeted to the oligohaline

zone as a VEC approach. This information will be incorporated into the next generation of hydrodynamic salinity models now under development. Improved models will provide District staff with an opportunity to reevaluate the proposed criteria and refine the St. Lucie River and Estuary MFLs in accordance with District regional water supply plan development.